

## REMARKS

Claims 1, 15 and 18 have been amended. Claims 1-4, 8, 9 and 12-18 remain for further consideration. No new matter has been added.

The objections and rejections shall be taken up in the order presented in the Official Action.

1. Claims 1-4, 8 and 12-18 currently stand rejected under 35 U.S.C. §102(b) for allegedly being anticipated by U.S. Patent No. 5,829,305 to Ham et al. (hereinafter “Ham”).

### INDEPENDENT CLAIM 1

Claim 1 has been amended to recite a worm gear mechanism for a power-assisted automobile steering mechanism that includes “*a rotatable cylindrical worm having a plurality of worm teeth that rotate about a first axis, each of the plurality of worm teeth having a first tooth face which includes a first convex region and a first concave region, where the first tooth face is disposed between a tip and a base*” and “*a rotatable cylindrical worm gear having a plurality of worm gear teeth that rotate about a second axis, each of the plurality of worm gear teeth having a second tooth face which includes a second concave region and a second convex region, where the second tooth face is disposed between a tip and a base”, “*where... the first tooth face and the second tooth face define a linear contact along one of a plurality of portions of a linear contact region that extends between the base of the worm gear tooth and the tip of the worm gear tooth.*” (Emphasis added). Applicants respectfully submit that Ham does not disclose such a worm gear mechanism.*

First, the Official Action contends that the claimed *linear contact* reads on the contact points 33, 35, 37 and 39 disclosed in Ham (see FIG. 2). In particular, the Official Action references pg 797 of *Mechanical Engineering Design, Seventh Edition* by Shigley et al. (hereinafter “Shigley”) to evidence that it was known in the art at the time of the invention that point contacts between a worm and a gear wear into line contacts. (Official Action, pg 2 and 4). Applicants respectfully submit, however, that Shigley is not a proper reference. Specifically, the present application was filed in the United States on November 14, 2003, which is *before* the 2004 copyright date of the 7<sup>th</sup> Edition of Shigley.

Even assuming, without admitting, that Shigley is a proper reference, applicants respectfully submit that it is unclear whether the “wear in” of the worm gear is a desirable trait. In particular, Shigley discloses that “[because] the teeth of worm gears have *point contact* changing to *line contact* as the gears are used, worm gears are said to ‘wear in,’ whereas other types ‘wear out.’” (Pg 797). That is, Shigley teaches that the change from point contacts to line contacts between a worm and a worm gear are *equivalent to the wearing out* of other gears, which is typically understood as an undesirable trait. In addition, Ham fails to teach or suggest that a user should continue to use the disclosed gears even after they have been worn. In particular, such gear wear could negatively affect the operation of the gears in Ham, which are clearly disclosed as having point contacts. (Ham, col. 3, lines 54-67). It is respectfully submitted, therefore, that Ham fails to disclose the claimed feature of “*where... the first tooth face and the second tooth face define a linear contact along one of a plurality of portions of a linear contact region that extends between the base of the worm gear tooth and the tip of the worm gear tooth.*” (Emphasis added).

Second, Ham discloses a system for driving a component that includes a worm gear 16 operatively associated with and coupled to a drive gear 18. (Col. 3, lines 15-38). As illustrated in FIGS. 1 and 2 (e.g., see Exhibit A below), Ham teaches that each tooth 18c1-18f1 of the drive gear 18 has a convex tooth face 18c1-18f1 disposed between a substantially straight tip (see “Q” in Exhibit A) and a concave base (see “R” in Exhibit A). Ham fails to disclose, therefore, that the tooth faces 18c1-18f1 of the drive gear teeth 18c-18f have the claimed *second concave* region.

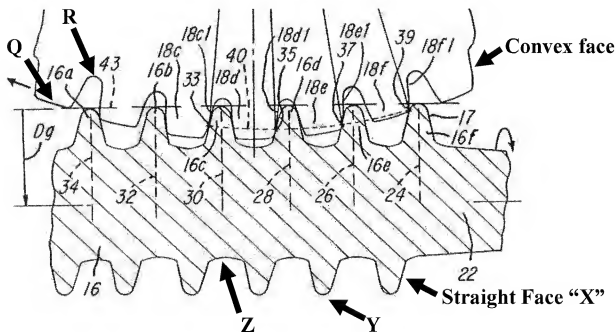


Exhibit A: FIG. 2 (annotated) of Ham

Ham further teaches, as illustrated in FIGS. 1 and 2, that each tooth 16a-16f of the worm gear 16 has a straight tooth face (see “X” in Exhibit A) extending between a convex tip (see “Y” in Exhibit A) and a concave base (see “Z” in Exhibit A). Alternately, in another embodiment, Ham teaches that the tooth faces X of the worm gear teeth 16a-16f can be curved to compliment the convex faces 18c1-18f1 of the drive gear teeth 18c-18f. (Col. 4, lines 27-28). That is, Ham

teaches that the tooth faces X of the worm gear teeth 16a-16f can be concave. Ham fails to disclose, therefore, that the tooth faces X of the worm gear teeth have the claimed *first convex region*.

A 35 U.S.C. §102(b) rejection requires that a single prior art reference disclose each feature of the claimed invention. Therefore, Ham is incapable of anticipating the worm gear mechanism recited in claim 1 since Ham fails to disclose at least the features of “*each of the plurality of worm teeth having a first tooth face which includes a first convex region...*” and “*each of the plurality of worm gear teeth having a second tooth face which includes a second concave region*”, “*where... the first tooth face and the second tooth face define a linear contact along one of a plurality of portions of a linear contact region that extends between the base of the worm gear tooth and the tip of the worm gear tooth.*” (Cl. 1, emphasis added). As a result, applicants respectfully submit that this rejection is now moot and should be withdrawn.

#### **DEPENDENT CLAIMS 2-4, 8 AND 12-14**

Applicants respectfully submit that these rejections are moot since claim 1 is patentable for at least the reasons as set forth above.

#### **INDEPENDENT CLAIM 15**

Claim 15 recites a worm gear assembly that includes:

*“a worm with a plurality of worm teeth that rotate about a first axis; and  
a worm gear with a plurality of worm gear teeth that rotate about a  
second axis;*

*where each tooth of the worm and each tooth of the worm gear has a concave profile in a region near a base of the tooth and a convex profile in a region near a tip of the tooth, where the region near the base of the tooth is closer to the base of the tooth than the tip of the tooth, and where the region near the tip of the tooth is closer to the tip of the tooth than the base of the tooth*

*where the worm and the worm gear mesh together in a first configuration such that one of the plurality of worm teeth and one of the plurality of worm gear teeth define a linear contact along one of a plurality of portions of a linear*

*contact region extending between the base of the worm and the tip of the worm.”*  
(Emphasis added).

As highlighted above, claim 15 distinguishes the region with the concave profile and the region with the convex profile from the base and the tip of each tooth. Specifically, claim 15 recites that the concave profile is in the region near and, thus, not the same as the base. Therefore, the claimed region with the concave profile cannot read on the tooth base R, Z of Ham (see Exhibit A above). Similarly, claim 15 recites that the convex profile is in the region near and, thus, not the same as the tip. Therefore, the claimed region with the convex profile cannot read on the tooth tip Q, Y of Ham (see Exhibit A above). As a result, applicants respectfully submit that Ham fails to disclose a worm gear assembly as recited in claim 15. Specifically, as set forth above, Ham fails to disclose that the face 18c1-18f1 of each drive gear tooth 18c-18f has “a concave profile in a region near a base of the tooth...” (Cl. 15, emphasis added). Ham also fails to disclose that the face X of each worm gear tooth 16a-16f has “a convex profile in a region near a tip of the tooth...” (Cl. 15, emphasis added). In addition, for at least the reasons set forth above with respect to claim 15, Ham also fails to disclose the feature of “where... one of the plurality of worm teeth and one of the plurality of worm gear teeth define a linear contact along one of a plurality of portions of a linear contact region extending between the base of the worm and the tip of the worm.” (Cl. 15, emphasis added). Applicants respectfully submit, therefore, that Ham is incapable of anticipating claim 15, and that this rejection should be withdrawn.

#### **DEPENDENT CLAIM 16**

Applicants respectfully submit that this rejection is moot since claim 15 is patentable for at least the reasons as set forth above.

## INDEPENDENT CLAIM 17

Claim 17 recites a worm gear assembly that includes “a *first gear having a plurality of first teeth each having a first tooth face that rotate about a first axis, each of the first tooth faces having a first profile including a first and a second linear contact surface*” and “a *second gear having a plurality of second teeth each having a second tooth face that rotate about a second axis, each of the second tooth faces having a second profile including a third and a fourth linear contact surface*...” (Emphasis added). Official Action contends that the claimed *linear contact surfaces* read on the contact points 33, 35, 37 and 39 disclosed in Ham (see FIG. 2). In particular, the Official Action references pg 797 of *Mechanical Engineering Design, Seventh Edition* by Shigley et al. (hereinafter “Shigley”) to evidence that it was known in the art at the time of the invention that point contacts between a worm and a gear wear into line contacts. (Official Action, pg 2 and 4). Applicants respectfully submit, however, that Shigley is not a proper reference. Specifically, the present application was filed in the United States on November 14, 2003, which is *before* the 2004 copyright date of the 7<sup>th</sup> Edition of Shigley.

Even assuming, without admitting, that Shigley is a proper reference, applicants respectfully submit that it is unclear whether the “wear in” of the worm gear is a desirable trait. In particular, Shigley discloses that “[because] the teeth of worm gears have *point contact* changing to *line contact* as the gears are used, worm gears are said to ‘wear in,’ whereas other types ‘wear out.’” (Pg 797). That is, Shigley teaches that the change from point contacts to line contacts between a worm and a worm gear are *equivalent to the wearing out* of other gears, which is typically understood as an undesirable trait. In addition, Ham fails to teach or suggest that a user should continue to use the disclosed gears even after they have been worn. In particular, such gear wear could negatively affect the operation of the gears in Ham, which are

clearly disclosed as having point contacts. (Ham, col. 3, lines 54-67). It is respectfully submitted, therefore, that Ham fails to teach or suggest the claimed feature of “*a first and a second linear contact surface*” and “*a third and a fourth linear contact surface....*” Applicants respectfully submit, therefore, that Ham is incapable of anticipating claim 17, and that this rejection should be withdrawn.

#### **INDEPENDENT CLAIM 18**

Applicants respectfully submit that claim 18 is patentable for at least similar reasons as set forth above with respect to claim 1.

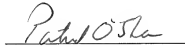
2. Claim 9 currently stands rejected under 35 U.S.C. §103(a) for allegedly being obvious in view of Ham and U.S. Patent No. 2,760,381 to Pickles (hereinafter “Pickles”).

Applicants respectfully submit that this rejection is now moot since claim 1 is patentable for at least the reasons as set forth above.

For all the foregoing reasons, reconsideration and allowance of claims 1-4, 8, 9 and 12-18 is respectfully requested.

If a telephone interview could assist in the prosecution of this application, please call the undersigned attorney.

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "Patrick J. O'Shea", is written above a horizontal line.

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